7.0 COMPARISON OF ALTERNATIVES AND RECOMMENDATION

An AA study has been completed to explore transit opportunities for connecting Los Angeles and Orange counties and serving future travel needs for the PEROW/WSAB Corridor. While focusing on the former Pacific Electric Railway right-of-way (ROW), the study evaluated possible connections from the ROW north to Union Station, and south to the Santa Ana Regional Transportation Center (SARTC). The purpose of the study was to identify and evaluate a wide range of possible transit system alternatives, and to provide the public and decision-makers with technical information on the future Corridor travel needs, and the benefits and impacts of each of the proposed transit alternatives. The study process included three phases of evaluation to screen a wide range of possible alternatives to the most viable alternative(s) that best meets the identified Corridor Purpose and Need and project goals. In this last study phase, the Final Set of Alternatives has been assessed through conceptual-level engineering and station design and related technical and environmental analytical efforts, and discussed through community and agency outreach activities. This section provides an overview of the results.

7.1 Purpose and Need

The PEROW/WSAB Corridor is a densely-developed area comprised of the most active hearts of Los Angeles and Orange counties, including downtown Los Angeles, the Gateway Cities subregion of Los Angeles County, the growing western and central portions of Orange County, and downtown Santa Ana. The Corridor has a diverse combination of residential neighborhoods, community civic centers, shopping districts and centers, educational institutions, and medical facilities. There are concentrations of employment centers ranging from industrial uses in the northern portion of the study area to office centers in downtown Los Angeles, Anaheim, and Santa Ana. In addition downtown Los Angeles and Santa Ana serve as the civic centers for each county. This Corridor has a significant number of regional and national destinations ranging from Staples Center in downtown Los Angeles at one end of the study area to Disneyland and Knott's Berry Farm at the other.

This unique Corridor was recommended for study as current and future congested travel conditions and limited transportation system connectivity will negatively impact the quality of life for residents, and the economic vitality of the Corridor's businesses and destinations making them less attractive to residents and visitors. An AA study was undertaken to look strategically at future mobility in this Corridor given the following trends:

- *High population and population density* – Home today to 4.5 million people, the Corridor's population is projected to grow by more than 500,000 new residents by 2035, or four times the population of San Diego, California's second largest city. Population density is projected to increase to an average of 12,000 people per square mile, with portions exceeding 14,000 residents per square mile. These trends are commensurate with densities successfully served by Metro and other urban rail systems.
- *High levels of employment and employment density* – In 2035, the Corridor will remain a major employment destination with more than 2.3 million forecasted jobs – three times higher than

San Diego's total employment. Future Corridor employment densities are forecasted to be 5,400 jobs per square mile, with areas exceeding that average with 9,000 to 14,000 jobs. In comparison, employment densities served by the Metro rail system range from 2,500 (light rail) to 14,000 (heavy rail) jobs per square mile.

- *Changing employment patterns* – While remaining a major employment center, the northern Los Angeles County portion of the Corridor, once the manufacturing heartland of Southern California, will continue to suffer disproportionately from long term economic structural changes resulting in the loss of approximately half a million jobs over the last 20 years. Future projections show a continuation of this trend. Providing residents in this portion of the Corridor with fast, direct transit access to employment opportunities elsewhere in the region will become of increasing importance. Conversely, the Orange County portion of the Corridor was forecasted to experience a large employment growth; accommodating increased peak period travel access will be important to maintaining this county's attractiveness as an employment destination.
- *Increasing transit-dependent population* – A Corridor-wide average of 16 percent of all households was identified as currently without access to an automobile. The number of transit-dependent residents is expected to increase reflecting the large number of low-income households, the continued loss of jobs in the northern portion, and an aging population.
- *Increasing travel demand* – By 2035, total daily travel originating and remaining in the Corridor are projected to increase by 36 percent with 12.8 million additional daily trips straining the existing transportation network.
- *Strained highway system* – Even with implementation of the planned highway improvements, increasing daily travel will adversely impact highway system capacity, and the level of service on the already congested highway network will continue to decline.
- *Limited travel options* – Currently, Corridor residents have two travel options – private automobile and bus transit – both of which operate on an increasingly congested highway system. Transit options are limited and include bus, local circulator, and two miles of east-west urban rail available in a portion of this north-south oriented Corridor. As a result, auto travel is the predominant travel mode with 86 percent of work trips made by car.
- *Limited connections to the regional rail system* – The Corridor has limited connections to the expanding urban rail system being implemented in the region. Currently, study area residents have only one connection to the Metro urban rail system, and two points of access to the regional Metrolink commuter rail system at either end of the Corridor. This lack of regional transit system linkages will become more detrimental to future Corridor travel and economic development as study area population and employment continue to grow.
- *Limited transit investment* – While a significant level of regional and local investments have been identified for the Corridor's freeway and arterial system, only minor transit improvements are planned, with minimal benefits. This lack of transit investment limits mobility and travel choices contributing to the study area's continued dependence on auto travel.

7.2 Evaluation Criteria

Corridor-specific goals and criteria were identified based on: local goals identified in consultation with elected officials, stakeholders, and the public; findings of the Corridor Mobility Problem and Purpose and Need analysis prepared as part of the AA study process; and applicable criteria of possible implementing and funding agencies. As documented in the *PEROW/WSAB Corridor AA Evaluation Methodology Report*, a detailed set of Corridor goals, criteria, and related performance measures were established to guide identification and evaluation of the proposed transit options. The identified criteria are intended to reflect the broad range of benefits and impacts that may be realized by the implementation of each of the proposed transit projects. The resulting criteria and related performance measures are presented in five categories that correspond to FTA New Starts project evaluation categories. While not currently a New Starts project, these evaluation areas are also used by state and regional agencies as well to evaluate possible projects.

1. Public and Stakeholder Support – the level of community, stakeholder, and jurisdictional support for the project.
2. Mobility Improvements – the level to which the project improves local and regional mobility and accessibility as measured by:
   - Provide another travel option.
   - Connect to the regional transit system.
   - Serve both community and regional trips.
   - Increase access to and from corridor destinations and activity centers.
   - Provide a fast travel speed.
   - Provide related pedestrian and bicycle facilities.
3. Cost-Effectiveness/Sustainability – provide a cost-effective solution where project costs are balanced with expected benefits, and the project funding needs fit within available funding resources.
4. Land Use/Economic Plans – implement a project that supports local and regional land use and development plans and policies:
   - Provide station location and spacing that supports local economic development and revitalization plans and goals.
5. Project Feasibility – assess the following for each alternative:
   - Fit with current local transit system operations or plans.
   - Has state and federally approved vehicles, and is operational in the U.S.
6. Environmental and Community Impacts – the extent to which the project provides additional travel capacity, while minimizing environmental and community impacts, and balancing distribution of benefits, impacts, and costs by mode, household income, and race/ethnicity.

The criteria and the performance measures used to evaluate the Final Set of Alternatives are presented in Table 7.1. A comparative analysis of the proposed transit system alternatives is discussed in the following sections.

Table 7.1 – Final Screening Evaluation Criteria

Criteria	Performance Measures
1. Public and Stakeholder Support	• Provide a desirable solution to the community and stakeholders. • Have city/jurisdictional support.
2. Mobility Improvements	• Improve travel speeds and reduce travel times. • Provide connections to the regional rail system. • Increase range of transportation options. • Serve current and future travel growth and patterns. • Serve both community and regional trips. • Make transit a viable alternative as measured by resulting ridership and new riders. • Increase access to and from Corridor activity centers and destinations. • Increase service for transit dependent Corridor residents. • Provide improved cross-county line transit service. • Provide an integrated pedestrian and bicycle system.
3. Cost-Effectiveness/Sustainability	• Balance project costs with expected benefits – resulting construction and operating costs are balanced by strong ridership (cost-effectiveness). • Identify transportation alternatives that are financially sustainable with identified resources.
4. Land Use/Economic Plans	• Provide station spacing that supports local economic development and revitalization plans and job strategies. • Serve areas with transit supportive land use policies.
5. Project Feasibility	• Fit with current local transit system operations or plans. • Has state and federally approved vehicles, and is operational in the U.S.
6. Environmental Benefits and Impacts	• Minimize environmental/community impacts • Improve air quality by reducing tailpipe and Greenhouse Gas emissions • Minimize the number of properties to be acquired. • Assess environmental justice impacts

7.3 Alternatives Considered

During the AA study process, a wide range of modal alternatives, along with possible alignment alternatives, was identified and evaluated. Based on Project Initiation efforts, nine Conceptual Alternatives were identified from previous studies and in consultation with elected officials, stakeholders, and city and agency staff. These options were analyzed and reduced to an Initial Set of Alternatives of six build options for further evaluation, which were evaluated and presented to stakeholders and the community for review and comment. In April 2011, the following six Final

Alternatives were approved by the Project Steering Committee for further study. The options include two baseline alternatives:

1 No Build – This alternative represents the completion of Corridor transit, highway, and other transportation projects that have approved local, county, state, and federal funding.

2. Transportation Systems Management (TSM) – This option maximizes the use and effectiveness of the existing transportation system through a set of proposed transit, highway, bicycle, and pedestrian projects. The TSM Alternative is presented as: a *Core Service Project* representing bus service providing a service alignment similar to the build alternatives – the Union Station-Los Cerritos Center service in Los Angeles County, and the Katella Avenue BRT Service in Orange County; and a *Corridor System* option which includes the Corridor-wide TSM transit and arterial system improvement projects identified with Metro and OCTA staff for Los Angeles and Orange counties respectively.

And four "build" or construct and operate a new transit system:

3. Bus Rapid Transit (BRT) – This build option represents a high capacity, high speed bus service primarily operating in dedicated lanes similar to the Metro Orange Line in Los Angeles County. Two BRT alternatives were identified: a *Street-Running* option providing limited stop service with signal priority improvements; and *HOV Lane-Running* express bus service operating in HOV lanes along the I-105 freeway and I-110/Harbor Transitway.

4. *Street Car* – This build alternative proposes a community-oriented rail system similar to that being considered by the cities of Santa Ana and Garden Grove in Orange County, and in operation in Portland and other U.S. cities.

5. *Light Rail Transit (LRT)* – This option consists of a rail system similar to the Gold and Blue lines operated by Metro in Los Angeles County.

6. *Low Speed Magnetic Levitation (Maglev)* – This alternative proposes service similar to that provided by the Linimo System operating in Nagoya, Japan.

The definition of the build alternatives was divided into three alignment sections for analytical purposes and to reflect different coordination requirements and possible phasing decisions. The three guideway alternatives have the following areas in common:

- Northern Connection Area – This portion of the study area extends north from the PEROW/WSAB ROW terminus in the City of Paramount to Union Station in downtown Los Angeles. Possible alignments were explored along several active and inactive railroad ROWs, and four alignment options were identified and evaluated.
- PEROW/WSAB Corridor ROW Area – This study area section was focused on the PEROW/WSAB ROW now owned by Metro and OCTA.
- Southern Connection Area – This study area section extends south from a proposed Santa Ana-Garden Grove Harbor Boulevard Street Car Station through the civic center and downtown areas

of the City of Santa Ana to the Santa Ana Regional Transportation Center (SARTC). Two alignment alternatives operating in the median of city streets were identified and evaluated.

While both BRT Alternatives were proposed to operate in dedicated lanes along the PEROW/WSAB Corridor and south through the City of Santa Ana similar to the guideway alternatives, their operation would differ in the Northern Connection Area. The Street-Running Option would provide limited stop service with signal priority improvements along Lakewood Boulevard, Firestone Boulevard, Long Beach Boulevard, Slauson Avenue, and Soto Street, with a stop at the Metro Gold Line Soto Street Station, and along Cesar Chavez Avenue to Union Station. The HOV Lane-Running Option would operate in HOV lanes along the I-105 and the I-110/Harbor Transitway and continue in street-running operations north to the 7th/Metro Center Station.

Northern Connection Area

For the guideway alternatives, two sets of alignment options for the connection north from the PEROW/WSAB ROW to Union Station, were proposed operating either along the east or west bank of the Los Angeles River:

- East Bank Alternative – This alignment alternative would operate north along the San Pedro Subdivision, cross a corner of the Hobart Intermodal Yard owned by Burlington Northern-Santa Fe (BNSF), to where the ROW intersects with the Union Pacific (UP)-owned ROW used for freight, Metrolink, and Amtrak operations. It would share the UP ROW for a short distance to where the ROW, now owned by Metro and operated by Metrolink, turns north to travel along the east bank of the Los Angeles River and then cross over the river into Union Station.
- West Bank Alternative – This alignment alternative would operate north along the San Pedro Subdivision to either operate along the west bank of the river to reach Union Station, or turn west to operate along a former railroad ROW and a Metro-owned ROW to reach Union Station. Three viable options were evaluated during the AA study:
  - West Bank 1 – This alternative would operate in its own ROW along the west bank of the Los Angeles River to just beyond the Redondo Junction where it would share the Metro-owned and Metrolink-operated ROW with Metrolink and Amtrak service, and possibly Metro Red Line operations.
  - West Bank 2 – This alternative would turn west to operate in the median of a infrequently used BNSF railroad ROW now owned by UP, through Huntington Park and then turn north to operate in the median of Pacific Boulevard, a former street car ROW until it intersects with the Metro-owned Harbor Subdivision. It would follow the Harbor Subdivision ROW under the Redondo Junction and then operate north along the west bank similar to West Bank option 1.
  - West Bank 3 – This alternative follows the same alignment as West Bank 2, but rather than turning to operate along the west bank of the river it continues north along the Harbor Subdivision and then along city streets and private property in a combination of aerial and

underground configurations to daylight south of Metro Gold Line Eastside Tokyo Station where it would utilize the existing at-grade Metro Gold Line tracks to reach Union Station.

Southern Connection Area

At the southern end of the PEROW/WSAB ROW, all the alternatives, except the Low Speed Maglev Alternative, would leave the ROW to operate either in the median or curbside of Santa Ana city streets along one of following two alternative routes:

- Westminster Boulevard/17th Street/Main Street – From the Harbor Boulevard Station, this service alignment would travel east on Westminster Boulevard/17th Street to Main Street where it would turn south to interface with the Street Car Main Street Station. Passengers would transfer to the Street Car system to reach the SARTC.
- Harbor Boulevard/1st Street/SARTC – From the Harbor Boulevard Station, this service alignment would travel south on Harbor Boulevard, turn east on 1st Street, and north on a realigned Santiago Street to the SARTC where passengers could transfer to Street Car, Metrolink, and Amtrak services, along with OCTA and international bus services.

Description of Alternatives

Detailed information was identified for the proposed alternatives, as documented in Chapter 3.0, including vehicle assumptions, service span and frequency, resulting run times, and average operating speeds.

The vehicles for the BRT Alternatives were assumed to be as follows:

- HOV Lane-Running Option – 45 foot NABI vehicles similar to those used for Metro Silver Line service, with the decision on whether to use the 60 foot articulated Metro Orange Line vehicles deferred to the future as ridership expands; and
- Street-Running Option – 40 foot NABI vehicles similar to those used for Metro Rapid service.

The Guideway Alternatives vehicle assumptions are as follows:

- Street Car – Reflecting the anticipated Santa Ana Street Car system, analysis was based on the Siemens S70 Street Car low-floor vehicle, 79'-1" in length, and operated as single cars.
- LRT Option – Vehicles similar to those used by Metro for their current LRT service, which are Breda 90' 2550 LRV vehicles and typically operated by Metro in a three-car consist.
- Low Speed Maglev Option – Vehicles used by the Linimo system in Nagoya, Japan, which are Nippon Sharyo HSST-100L vehicles built as an integrated, three-car consist 134'-7" in length.

The LRT and proposed Street Car vehicles are approved for use by the California Public Utilities Commission (CPUC), while the Low Speed Maglev vehicles would require CPUC approval.

Existing bus services in the PEROW/WSAB Corridor are primarily operated by Metro and OCTA, while existing urban rail service is operated by Metro, and there is no current operator for the Street Car and

Low Speed Maglev Alternatives. For the AA-level of analysis of operating plans, Metro was assumed to be the operating agency for all of the alternatives, and the service frequency and span was based on their current policies and future plans. During any subsequent planning efforts, the operator decisions would be revised to reflect evolving operator capabilities.

Using the alternative definition information documented in Chapter 2.0 and the operating inputs presented in Chapter 3.0, including the alternative alignment length and number of stations, end-to-end run times and the average speed were identified for each alternative and are summarized in Table 7.2.

Table 7.2 – Alternative Definition and Resulting Operational Information

Alternative	Number of Stations[1]	Distance[2] (Miles)	Run Time	Average Speed (mph)
BRT				
HOV Lane-Running	22	39.0	1:18:30	32.6
Street-Running	27	38.2	1:21:11	30.3
Street Car				
East Bank 1	23	35.2	1:09:55	30.7
West Bank 1	22	35.2	1:08:20	31.6
West Bank 2	23	35.6	1:10:36	30.7
West Bank 3	24	34.5	1:07:15	31.1
LRT				
East Bank 1	22	35.2	1:02:09	35.3
West Bank 1	21	35.2	1:00:55	35.8
West Bank 2	22	35.6	1:03:45	34.4
West Bank 3	23	34.5	1:00:12	35.5
Low Speed Maglev				
East Bank 1	17	29.7	43:06	40.2
West Bank 1	16	29.6	42:39	41.0
West Bank 2	17	29.9	44:18	40.0
West Bank 3	18	29.2	43:00	40.2

[1] Represents the Harbor Boulevard/1st Street/SARTC Alternative in the Southern Connection Area.
[2] Low Speed Maglev Alternative ends at Harbor Boulevard; does not continue through Santa Ana.

The Final Set of Alternatives were evaluated based on an AA-level (five percent) engineering and operating design, station location, capital and operating cost estimates, ridership forecast modeling, and community and environmental impact analyses. The following sections summarize the technical results. In summary, while providing a new transportation improvement is important to the future mobility and vitality of the Corridor communities, adding any major transit system improvement into this densely built-out, urban corridor will have significant benefits and impacts.

7.4 Public Input

Community, stakeholder, elected official, and agency input has been integral in shaping the PEROW/WSAB Corridor AA process and guiding the direction of the project. Stakeholder comments were received and documented over the course of the 26-month study at meetings and work sessions with elected officials, stakeholders, advisory committee members, and the community. The following major project themes were identified during these outreach efforts:

- *Current and future traffic congestion will constrain car travel* – Elected official and community members expressed frustration with current congestion on freeways and arterial streets, and were concerned that congestion could get worse in the future as many freeways and roads are already at or near capacity. They anticipated that future population growth will likely increase the number of cars on the road, and thought that the limited ability to expand the existing highway system would be a significant mobility issue in the future.
- *Current public transit systems do not adequately serve transportation needs* – One of the strongest recurring concerns identified was the perception that current local bus transit is inconvenient, inefficient, and inflexible. Other areas of concern related to existing transit were infrequent service, limited hours of operation, slow travel speeds, and the need for frequent transfers, along with a lack of coordination between multiple transit modes and providers making reaching final destinations by transit more difficult.
- *Enthusiasm for providing public transit in the Corridor* – Throughout the study, public participants remained excited about the potential for providing high capacity, high speed transit in the Corridor, and were eager to consider and discuss different transportation solutions. They saw the need for public transit to meet future local and regional transportation challenges. Many community members felt that the PEROW/WSAB Corridor ROW was a unique asset that provides a special opportunity to provide a critical link between Los Angeles and Orange counties.
- *Opportunities for development and neighborhood revitalization along transit service in the Corridor* – Elected officials, agency staff, and community members were interested in the possibility that a Corridor transit investment could provide a catalyst for needed residential and commercial development. In general, participants felt that mixed-use development near transit stations would be attractive due to the ease of accessing transit, providing connections to jobs, goods, and services, and creating an attractive, pedestrian-friendly environment.
- *Widespread support for trails and open space adjacent to the transit system* – Many community members were supportive of creating a linear bicycle and pedestrian trail along the length of the PEROW/WSAB Corridor ROW, and possibly providing dedicated open space adjacent to the transit system. Many participants believed that this pathway system would provide additional connections between stations that would complement and increase the use of a transit system.

During the Initial Screening phase, community and stakeholder comments received on the alternatives included the following:

- *The No Build Alternative was preferred by some Orange County residents living along the PEROW/WSAB Corridor ROW.* Residents expressed significant concerns about implementing a transit system, which would negatively impact their quality of life and property values. The key concerns expressed were related to noise, vibration, and traffic impacts.
- *Bus Rapid Transit (BRT) was seen as a pragmatic and sensible solution, but with significant obstacles to successful implementation.* BRT was viewed possibly as a good solution due to its relatively low cost to build and operate, and perceived shorter construction time. Overall, BRT received lackluster support because many people expressed doubts that the negative public perception of buses could be overcome. Community members doubted its efficiency without dedicated lanes beyond the PEROW/WSAB Corridor ROW.
- *Although not widely considered a right fit for the Corridor, Street Car service was viewed favorably.* Participants liked the street car vehicle, and its slow travel speed was viewed as possibly having less community and environmental impacts than the other alternatives. However, a majority of the community members did not see it as a right fit for this Corridor. The slow travel speed and frequent stops were perceived as meeting local transit needs, but not as addressing regional transportation needs viewed as essential for connecting the Corridor communities.
- *Strong support was expressed for Light Rail Transit (LRT) based on its potential for serving all of the community's transportation needs.* Community members indicated the strongest preference for the LRT option. Many considered it to be an efficient system that would provide the right balance between local and regional service for Corridor communities. Participants felt the station spacing would support community economic development and revitalization needs. LRT was viewed as a familiar technology that has been proven successful locally.
- *A High Speed Maglev Alternative was presented, with many participants expressing that it was an unreasonable solution, but others suggesting a lower speed option that could meet community needs.* Participants were not generally supportive of high speed maglev service, and some people proposed a Low Speed Maglev system option that would have more station stops. Those participants felt that it was more of a cutting-edge approach, and would provide cleaner and quieter service. Others expressed concerns that the technology was unproven in the U.S. and would be incompatible with existing systems.

7.5 Mobility Improvements

An overview of the resulting mobility improvements provided by the Final Set of Alternatives is presented below in Table 7.3. In summary of how the Final Set of Alternatives address and meet the following Mobility Improvement criterion:

- *Increase the range of transportation options* – All of the alternatives provide new transit services in the Corridor. The community and many of the cities expressed the belief that the bus services provided by the TSM and BRT Alternatives did not provide a new transportation option, but were a continuation of the existing limited options operating on the same congested streets as vehicular traffic.
- *Provide connections to the regional transportation system as identified by the Long Range Transportation Plans adopted by Metro and OCTA* – All of the alternatives would provide connections to the future regional transportation system.
- *Provide improved linkages to the Los Angeles County Metro Rail system and increase access to the Metrolink system for Corridor Study Area residents* – All of the alternatives would provide connections to the future regional transportation system with variations in travel speeds and resulting travel times.
- *Minimize transfers by providing end-to-end Corridor Study Area service* – All of the alternatives would provide end-to-end study area service, except the Low Speed Maglev Alternatives based on current City of Santa Ana input. This alternative would end at the future Santa Ana-Garden Grove Street Car Harbor Boulevard Station where Low Speed Maglev passengers would be required to transfer to the future Street Car system to complete their trip to downtown Santa Ana and the SARTC. In addition, the Westminster Boulevard/17th Street/Main Street alignment alternative would require Street Car and LRT passengers to transfer to the Santa Ana-Garden Grove Street Car system at the Main Street Station to complete their trip to the SARTC.
- *Increase access to Corridor activity centers and destinations* – All of the alternatives would improve access to study area activity centers and destinations.
- *Increase service for transit-dependent Corridor residents* – All of the alternatives would provide improved service for transit-dependent Corridor residents
- *Provide an integrated pedestrian and bicycle system* – All of the alternatives could provide an integrated pedestrian and bicycle system along large segments of the Corridor Study Area, but freeway underpassing ROW width constraints and the inability to share freight rail ROWs appear to preclude provision of an end-to-end system.
- *Serve major transit hubs* – Currently, the major Corridor transit hubs are located at Union Station and the Santa Ana Regional Transportation Center, with a minor transit hub providing mid-corridor access to the Metro Rail system at the Metro Green Line Lakewood Boulevard Station. All the alternatives provide connections to these three transit hubs, except the Low Speed Maglev Alternative which would not connect with the SARTC. Implementation of the proposed alternatives will result in the creation of new transit hubs with connecting bus service.

Differences in the mobility improvement areas between the alternatives include the following:

- *Improve travel speeds over current and future transit and auto travel speeds* – As shown above in Table 7.2, not all of the alternatives would provide improved average travel speeds, but still may provide improved travel times due to the ability to run in dedicated operations along the PEROW/WSAB ROW. Though slower than the other transit system options, the BRT and Street Car Alternatives still are projected to operate in the 30-33 mph range. As identified by stakeholders and the public, the two criterion used to determine whether an alternative improves travel speed were: average Metro Blue Line travel speed (25 mph); and average peak period freeway travel speed (used the current and forecast 2035 peak period for the I-5 Freeway, with peak period travel at 35 mph or less).

Table 7.3 –System Travel Times

Alternative	Union Station-Metro Green Line (Minutes:Seconds)	Metro Green Line-Harbor Boulevard (Minutes:Seconds)	Harbor Boulevard-SARTC (Minutes:Seconds)	Total Trip (Hours: Minutes:Seconds)
BRT Alternatives				
Street-Running	34:06	32:36	14:29	1:21:11
Street-Running	31:25	32:36	14:29	1:18:30
Street Car Alternatives				
‣ East Bank	23:55	32:47	13:13	1:09:55
‣ West Bank 2	24:36	32:47	13:13	1:10:36
‣ West Bank 3	21:15	32:47	13:13	1:07:15
LRT Alternatives				
‣ East Bank	21:45	27:53	12:31	1:02:09
‣ West Bank 2	23:21	27:53	12:31	1:03:45
‣ West Bank 3	19:48	27:53	12:31	1:00:12
Low Speed Maglev Alternatives				
‣ East Bank	17:56	25:10	NA	--
‣ West Bank 2	19:08	25:10	NA	--
‣ West Bank 3	17:50	25:10	NA	--

- *Serve both local and regional trips* – The BRT and Street Car alternatives more typically serve local trips, while the LRT and Low Speed Maglev options serve both local and regional trips.
- *Serve current and future travel growth and patterns* – Based on the resulting capacity analysis, the BRT and Street Car alternatives may not provide sufficient capacity to accommodate the future Corridor ridership; and the TSM Alternative may be constrained in serving future transit demand due to operating on the Corridor's highway system that is forecasted to experience increased congestion.

Travel times could be further reduced for the Street Car and LRT Alternatives by operating them in an entirely grade-separated system similar to the Low Speed Maglev Option. Table 7.4 presents a comparison of the travel times for the current system configuration incorporating at-grade and grade-separated operations. Based on an AA-level of system design, the end-to-end travel time from Union Station to the SARTC for the LRT West Bank 3 Alternative would be shortened by just over three minutes. The minor increase represents several constraints and assumptions. At this level of analysis, the run time for both PEROW/WSAB Area alignment alternatives is the same as the current LRT alignment has a major curve (PEROW/WSAB ROW to the San Pedro Subdivision) that requires a speed reduction whether in at-grade or grade-separated operations. This connection could be modified to run faster, but would require major residential property acquisition to do so. In addition, the run time for the combination alternative was based on an assumption of new signals in roadway segments adjacent to stations and signals priority at all other crossings. Also, the West Bank 3 combination alignment alternative was already designed with a 27 percent grade-separated configuration. Analyzing the trade-offs related to grade separation would be refined during any subsequent engineering work based on the Metro *Grade Crossing Policy,* which provides a process for making grade separation decisions based on detailed highway system analysis and transit system design.

Table 7.4 – LRT West Bank 3 Alternative: All Grade-Separated System Travel Times

Operational Alternative	Northern Connection Area (Minutes:Seconds)	PEROW/WSAB Area (Minutes:Seconds)	Southern Connection Area (Minutes:Seconds)	Total Trip (Minutes:Seconds)
Combination: at-grade and grade-separated	19:48	27:53	12:31	60:12
All grade-separated	18:30	27:53	10:47	57:10

Currently, the guideway alternatives have an average station spacing of approximately of two miles between stations. If peak period express or skip-stop service with a five-mile station spacing were implemented, an end-to-end travel time savings of eight minutes could result as shown in Table 7.5. The proposed major stations considered in this analysis were Union Station, Pacific Boulevard, Firestone Boulevard, the Metro Green Line, 183rd Street/Gridley Road, Beach Boulevard, Harbor Boulevard, and SARTC. Further evaluation of express service and the stations to be included may be studied through possible future study efforts, though it is not current Metro policy.

Table 7.5 – LRT West Bank 3: Skip Stop System Travel Times

Operational Sections	All Proposed Station Stops (Minutes:Seconds)	Possible Skip Stop Stations (Minutes:Seconds)
Northern Connection Area	19:48	17:28
PEROW/WSAB Area	27:53	24:04
Southern Connection Area	12:31	10:34
Total	60:12	52:06

Forecasted Ridership

Ridership projections were prepared using a Corridor-specific model developed from the FTA-reviewed Metro travel demand model that was expanded to include both Los Angeles and Orange counties, and was validated for existing conditions. Due to the significant number of modal and alignment alternatives, the decision was made to perform detailed coding and analysis of a set of base alternatives, along with a series of sensitivity tests to explore other alignment options and system decisions. Also, the West Bank 1 and 2 alignments were so similar in length, number of stations, and physical setting, that only the West Bank 2, which had more agency interest, was analyzed. The full model runs are indicated by a tone in Table 7.6 that presents the forecast ridership and user benefits.

The modeling results for 2035 show a strong increase in daily transit boardings in the PEROW/WSAB Corridor with implementation of any of the proposed transit system alternatives, clearly demonstrating the travel demand and need for more transit in the study area. At one end of the transit investment spectrum, the TSM Core Service Project option, which represents the two bus service lines that would serve the same travel corridor as the build alternatives: Union Station-Los Cerritos in Los Angeles County and the Katella Avenue BRT in Orange County. This option would attract and serve 39,000 daily Corridor boardings and approximately 16,000 new riders by the year 2035. At the other end of the ridership spectrum, the approximately 35-mile long LRT alternatives would have the highest projected daily boardings among the guideway options with 82,900 to 87,150 daily boardings, and attracting up to 32,900 new transit riders.

Table 7.6 – Forecast Ridership (2035)

Alternative	Total Daily Corridor Boardings	Daily New Transit Riders	Daily User Benefits Per Project Boarding (Minutes)	Daily User Benefits (Hours)
No Build	49,760	--	--	--
TSM				
▸ Core Service Project[1]	39,000	16,000	N/A	N/A
▸ Corridor System	85,575	35,815	22.2	21,720
BRT Alternatives				
▸ Street-Running	57,340	18,120	13.2	12,605
▸ HOV Lane-Running	67,210	26,640	15.7	17,580
Street Car Alternatives				
▸ East Bank 1	77,545	28,900	18.9	23,240
▸ West Bank 2	75,750	27,550	18.5	24,365
▸ West Bank 3	79,600	28,945	18.6	24,635
LRT Alternatives				
▸ East Bank 1	84,895	32,730	18.9	26,780
▸ West Bank 2	82,930	31,200	18.5	25,540
▸ West Bank 3	87,150	32,870	18.6	27,075
Low Speed Maglev				
▸ East Bank 1	74,020	28,430	19.2	22,635
▸ West Bank 2	72,310	26,985	18.8	23,735
▸ West Bank 3	75,990	28,430	18.9	23,995

Notes: Tone indicates a coded model run; ridership numbers with no tone were derived from sensitivity runs.
[1] Ridership for two bus service projects that represent the same travel corridor as the build alternatives.

A model run was performed to evaluate the ridership impact of operating the LRT Alternative from one identified in the run time analysis spreadsheets to a speed more comparable to actual Metro Rail operations experience. The Metro Blue Line section between the Washington and Willow stations was identified as having an operational configuration similar to that proposed for the PEROW/WSAB Corridor project. This segment operates northbound at 29.7 mph and southbound at 32.9 mph; the northbound speed was used in a run time analysis for the LRT West Bank 3 Alternative that resulted in an average speed of 29.9 mph due to the grade-separation in the northern portion of the alignment. The results presented in Table 7.7 show an increase in end-to-end run time (Union Station to SARTC) of more than five minutes. The eight percent reduction in average speed was forecasted to result in a corresponding eight percent decrease in daily corridor boardings (6,700 fewer riders) and a ten percent decrease in new riders (3,400 less).

Table 7.7 – Comparison of Forecast Ridership based on Metro Blue Line Operating Speed (2035)

Speed Alternative	Average Speed (mph)	Run Time[2] (Mins:Secs)	Total Daily Corridor Boardings	Daily New Transit Riders	Daily User Benefits Per Project Boarding (Minutes)	Daily Total User Benefits (Hours)
Run Time Analysis	35.5	1:00:12	87,150	32,870	18.6	27,075
Metro Blue Line[1]	29.9	1:05:49	80,460	29,435	18.5	24,810

[1] Based on run time analysis using FY2011 Metro Blue Line northbound average speed of 29.7 mph.
[2] End-to-end run time from Union Station to SARTC for LRT West Bank 3 Alternative.

The first sensitivity test evaluated the ridership impact of entirely grade separating the LRT Alternative using the West Bank Option 3 alignment as the test case. The base ridership projections previously presented in Table 7.6 for the LRT options were based on the construction of an alignment that was a combination of grade-separated and at-grade operations. For the West Bank 3 alignment, 27 percent of the Northern Connection Area was grade-separated, as were eight percent of the PEROW/WSAB and Southern Connection areas. Future system decisions may be made to entirely grade-separate the LRT alignment to improve system performance and reduce traffic impacts. The results of the sensitivity run (Table 7.8) show a slight increase in daily boardings (three percent), new transit riders (four percent), user benefits (four percent), and user benefits per project boarding (two percent). The slight growth in ridership is due to a minor increase in operating speed and decrease in run time.

Table 7.8 – Sensitivity Test: Entirely Grade-Separated LRT Alternative (2035)

Statistic	Combination Alignment	Fully Grade-Separated Alignment
Daily Project Boardings	87,150	89,560
Daily New Riders	32,870	34,320
Daily User Benefits (Hours)	27,075	28,150
User Benefits Per Project Boarding (Minutes)	18.6	18.9

A second sensitivity test evaluated ridership impacts for the Low Speed Maglev Alternative based on whether this option was operated by a private operator rather than a public agency such as Metro or OCTA. This alternative differs from the other Low Speed Maglev alternatives only in the amount charged for passengers to use the system. The West Bank 3 alignment option was used as it had the highest forecasted ridership of the Low Speed Maglev alternatives and would represent the best case scenario. The identified difference reflects the fare required to generate the operating revenue required to support a public-private partnership with different financing tools and return needs than an entirely publicly-funded project. A revised fare assuming private operations was calculated through financial

analysis effort and then used in the Corridor model in place of the Metro rail system fare. The resulting private operations fare was identified as $8.75, and the significant impact on project ridership is presented in Table 7.9. The analysis showed that the public fare-based ridership of 75,990 daily boardings was forecasted to be reduced by 89 percent to 8,255 daily boardings. The results show that in this Corridor, with a large percentage of low-income households, riders would find less expensive travel alternatives to avoid paying the higher fare.

Table 7.9 – Low Speed Maglev Alternative: Private Fare (2035)

Statistic	Public Fare-Based Ridership	Private Fare-Based Ridership
Daily Project Boardings	75,990	8,255
Daily New Riders	28,430	3,090
Daily User Benefits (Hours)	23,995	2,610
User Benefits Per Project Boarding (Minutes)	18.9	18.9

A final set of sensitivity tests evaluated the resulting ridership if the Corridor project were built in Los Angeles County with the following MOS segments using the LRT West Bank 3 Alternative:

- MOS 1 – With a use agreement for the San Pedro Subdivision and construction of a new Metro Green Line station, implementation of the system section connecting north to Union Station;
- MOS 2 – Implementation of the segment from the new Metro Green Line station along the WSAB Corridor ROW to the future Bloomfield Avenue Station located in Cerritos just west of the county line; and
- Both – If both MOSs were constructed from Union Station to the proposed Bloomfield Station in Cerritos and went into operation at the same time.

Table 7.10 – Ridership Projections for Minimum Operable Segments in Los Angeles County

Statistics	MOS 1 Union Station to Metro Green Line[1]	MOS 2 Metro Green Line[1] to County Line	Both Union Station to County Line
Daily Project Boardings	19,620	11,060	38,790
Daily Corridor Boardings	103,820	111,070	125,540
Daily New Riders	1,850	3,350	9,790
Daily User Benefits (Hours)	2,330	3,360	9,940
Daily User Benefits (Minutes)	7.1	18.2	15.4

[1] Based on new Metro Green Line Station to be accessed from the San Pedro Subdivision.

The ridership results presented in Table 7.10 show a strong level of ridership in the Union Station to Metro Green Line portion of the Corridor. This section currently has a high level of transit ridership (15 percent) and the low number of new riders indicates that the project would be primarily serving existing riders better with faster, more direct service. Building and operating MOS 2 alone would attract a lower level of total riders than MOS 1, but it would attract three times more new riders than MOS 1 resulting in a higher level of user benefits. The synergy resulting from operation of both segments is demonstrated by a resulting higher level of ridership than if the ridership of the two segments were added together. Building both segments would result in three times more new riders than MOS 2 alone, and almost nine times more than only MOS 1. The total forecasted ridership for the Los Angeles County only portion of the Corridor system is strong, but not as significant as if a Corridor transit project were to provide service connecting the two counties and their jobs and destinations.

7.6 Cost-Effectiveness/Sustainability

The evaluation of the Corridor AA alternatives was based on an analysis that weighs the benefits accruing from each transit option against their cost and impacts. In this evaluation category, the transportation system efficiency, or the cost-effectiveness, of each option was identified. Cost-effectiveness is a measure used to evaluate how the costs of a transit project (for both construction and operations) compare to the expected benefits (increased transit ridership and user travel time savings benefits). The following discussion presents the capital costs, operating and maintenance (O&M) costs, and the projected ridership for each alternative.

Capital Costs

Table 7.11 presents order of magnitude project capital cost estimates identified for the TSM Alternative and four build options and were divided into each of the three Corridor areas. This was to allow for consideration of the varied alignment sections and their costs, and provides a basis for the consideration of possible MOSs in the identification of a preferred transit strategy or phasing of strategies that is discussed below.

The No Build Alternative was not included in this effort, as all No Build costs are considered to be within the financial capability of Metro and OCTA as reflected in their adopted LRTPs. The transit service projects included in the TSM Alternative were identified with Metro, OCTA, and Long Beach Transit staff, and project costs were based on cost projections developed by each agency or identified in cooperation with the transit agencies. The conceptual estimated costs were reviewed with Metro and OCTA staff and compared to historical pricing data received from Metro and the Exposition Authority and the costs were increased by 27.8 percent reflecting the analytical results.

The modeling results show a strong increase in daily transit boardings in the PEROW/WSAB Corridor with implementation of any of the proposed transit system alternatives, clearly demonstrating the travel demand and need for more transit in the study area. At one end of the transit investment spectrum, the TSM Core Service Project option, which represents the two bus service lines (approximately 34 miles in

Table 7.11 – Capital Cost Breakdown (FY 2010 dollars)

Modal/Alignment Alternative	TSM Cost (Millions)	Main. Yard Cost (Millions)	Vehicle Cost (Millions)	Construction Cost (Millions)	Total Project Cost (Millions)
BRT Alternatives					
▸ Street-Running	$239.2	$184.0	$9.0	$643.0	$1,075.2
▸ HOV Lane-Running	$239.2	$184.0	$18.0	$640.4	$1,081.6
Street Car Alternatives					
▸ East Bank 1	$239.2	$184.0	$411.6	$1,739.9	$2,574.7
▸ West Bank 1	$239.2	$184.0	$396.9	$1,790.9	$2,611.0
▸ West Bank 2	$239.2	$184.0	$411.6	$1,749.5	$2,584.3
▸ West Bank 3	$239.2	$184.0	$396.9	$2,098.0	$2,918.1
LRT Alternatives					
▸ East Bank 1	$239.2	$184.0	$371.1	$2,174.9	$2,969.2
▸ West Bank 1	$239.2	$184.0	$356.5	$2,130.2	$2,909.9
▸ West Bank 2	$239.2	$184.0	$382.2	$2,092.9	$2,898.3
▸ West Bank 3	$239.2	$184.0	$356.5	$2,436.8	$3,216.5
Low Speed Maglev Alternatives					
▸ East Bank 1	$239.2	$184.0	$540.0	$5,657.5	$6,620.7
▸ West Bank 1	$239.2	$184.0	$540.0	$5,651.1	$6,614.3
▸ West Bank 2	$239.2	$184.0	$562.5	$6,191.7	$7,177.4
▸ West Bank 3	$239.2	$184.0	$540.0	$6,513.5	$7,476.7

length) that would serve the same travel corridor as the build alternatives: Union Station-Los Cerritos in Los Angeles County and the Katella Avenue BRT in Orange County. This option would attract and serve 39,000 daily Corridor boardings and approximately 16,000 new riders by the year 2035. A higher level of ridership would be served by the TSM Corridor System option, which includes a 206-mile system of new and enhanced bus services and arterial and intersection operational improvements. This alternative would attract and serve 85,575 daily Corridor boardings primarily in Orange County; only one new Metro bus line and one new Long Beach Transit line is proposed in Los Angeles County compared to improved service on three lines and provision of five new lines in Orange County. At the other end of the ridership spectrum, the approximately 35-mile long LRT alternatives would have the highest projected daily boardings among the guideway options with 82,900 to 87,150 daily boardings, and attracting up to 32,900 new transit riders.

The BRT Alternatives were forecasted to serve an additional 57,000 daily Corridor boardings for the Street-Running Alternative, and 67,000 daily boardings for the HOV Lane-Running Alternative. These two options would attract the lowest number of daily boardings and new riders among the proposed alternatives, other than TSM Core Service Project. For both BRT options, it should be noted that the

projected ridership would significantly exceed the hourly and daily capacity typically provided by a BRT system. For example, the Metro Orange Line served 26,900 daily boardings in September 2011.

Construction of the Street Car Alternatives was forecasted to serve from 77,545 to 79,600 daily Corridor boardings, and attract an average of 28,400 daily new transit riders. It should be noted that the forecasted ridership information was based on operating three-car trains using the same street car vehicle proposed for use by the Santa Ana Street Car system. Research identified that the vehicle cannot be coupled together into two or three car trains, but must be operated singly. The capacity provided by a system of single Street Car vehicles would not accommodate the Corridor's forecasted ridership demand.

Daily boardings among the LRT Alternatives were forecasted to be between 82,900 and 87,150 daily boardings, and would attract an average of 32,270 daily new riders. The West Bank 3 Alternative was projected to attract and serve the highest level of daily boardings (87,150) and new riders (32,900) due to having the fastest travel speeds and shortest end-to-end travel times. Looking at forecasted daily user benefits per project boarding, the LRT alternatives are similar to the Street Car and Low Speed Maglev options, but have the highest user benefits on a daily total user benefit basis among the alternatives.

Daily boardings among the Low Speed Maglev Alternatives was forecasted to serve from 72,300 to 76,000 daily Corridor boardings, and attract an average of 27,950 daily new transit riders on a system that is approximately five miles shorter than the other guideway alternatives. The East Bank alignment option has the highest daily user benefits per project boarding among the alternatives, though the total daily user benefits are lower than the LRT Alternatives.

Operating and Maintenance Costs

Operating and maintenance (O&M) costs are those related to the day-to-day operations of the proposed transit service including labor, vehicle maintenance, and overall transit system maintenance. O&M costs were projected based on the level of service and unit costs for each alternative as discussed in Chapters 3.0 and 5.0.

Project level of service was estimated based on operating plans prepared for each alternative incorporating information including vehicle revenue miles, vehicle revenue hours, and peak vehicles. The O&M unit cost estimates presented below presented in Table 7.12, the costs are based on all Metro operations. To derive unit costs, the total expenses assigned to each supply variable were divided by the annual service quantities; and the unit cost for each supply variable was multiplied by the projected annual units of service to identify annual O&M costs. During any subsequent engineering and environmental review efforts, system components and requirements would become more detailed and updated operator-specific O&M cost assessments would be prepared.

Table 7.12 – Estimated Annual O&M Costs (FY 2011 dollars)

Alternative	Total Annual O&M Cost (Millions)	Incremental Cost over TSM (Millions)
TSM Alternative		
▸ Corridor System	$56.9	--
BRT Alternatives		
▸ Street-Running	$41.6	($15.3)
▸ HOV Lane-Running	$53.1	($3.8)
Street Car Alternatives		
▸ East Bank 1	$217.9	$161.0
▸ West Bank 1	$216.8	$159.9
▸ West Bank 2	$219.4	$162.5
▸ West Bank 3	$217.5	$160.6
LRT Alternatives		
▸ East Bank 1	$216.0	$159.1
▸ West Bank 1	$210.0	$153.1
▸ West Bank 2	$214.1	$157.2
▸ West Bank 3	$204.0	$147.1
Low Speed Maglev Alternatives		
▸ East Bank 1	$152.3	$95.4
▸ West Bank 1	$155.1	$98.2
▸ West Bank 2	$153.2	$96.3
▸ West Bank 3	$151.9	$95.0

Funding Feasibility

As discussed in Chapter 5.0, while there is Measure R funding dedicated to the Los Angeles County portion of any identified project, it is insufficient to fund a majority of the proposed alternatives. This project is not currently included in Metro's list of projects seeking federal New Starts funding. Orange County's Measure M program does not identify any funding for this project at this time. Additional funding would need to be identified and an analysis of resources that could be generated through an increase in county-based sales tax is presented in Chapter 5.0.

Cost-Effectiveness

Projects that utilize the FTA New Starts program to obtain federal funding are evaluated in a number of categories including the Cost-Effectiveness, which is a measure of the hours saved by users of the project compared to its annual cost. While not currently a New Starts project, CEI provides a good comparison measure of the benefits and impacts for the proposed alternatives. The Cost-Effectiveness Index (CEI) was calculated for each build alternative by comparing its annual cost (combined annualized

capital cost and annual operations and maintenance cost) and annual hours saved as compared to the TSM Alternative. While the PEROW/WSAB Corridor AA is not currently in any Metro request for New Starts funding, the CEI measure remains a meaningful way of evaluating the cost-effectiveness of the potential transit investment. Generally, a project must have a CEI of under $25 to move forward into the next study phase and eventually qualify for federal New Starts funding. It should be noted that the CEI threshold, and its importance to a project moving forward, does change over time due evolving federal funding priorities.

A "provisional" CEI has been calculated for each alternative using the West Bank 3 alignment, and is presented in Table 7.13 along with other measures of effectiveness (incremental cost per new rider and incremental cost per project boarding). The resulting CEIs are considered to be provisional because the current TSM alternatives most likely will require revision if any project alternative from this AA is considered for New Starts funding in the future. This issue is discussed below in more detail.

Table 7.13 – Cost-Effectiveness Indices (2035)

Alternative	Average Weekday User Benefits (Hours)	Average Annual User Benefits (Hours)	Cost-Effectiveness Index
TSM			
▸ Corridor System	331,720	10,058,475	$8.15
BRT Alternatives			
▸ Street-Running	12,605	3,997,365	$20.47
▸ HOV Lane-Running	17,575	5,573,670	$16.60
Street Car Alternative			
▸ West Bank 3	24,635	7,811,760	$51.44
LRT Alternative			
▸ West Bank 3	27,075	8,585,485	$48.23
Low Speed Maglev Alternative			
▸ West Bank 3	23,995	7,608,500	$89.90

The TSM Alternative has the highest average daily and annual user benefits and the lowest CEI of the proposed options. The BRT alternatives currently meet the FTA threshold for cost-effectiveness, but have the lowest average daily and annual user benefits. The LRT West Bank 3 Alternative was forecasted to have the lowest CEI of the guideway alternatives, but at this point is above the FTA threshold. The CEI for the Street Car Option is close to the LRT Alternative, but is more than nine percent higher and has approximately 774,000 less hours of annual user benefits. The Low Speed Maglev Alternative has the lowest CEI of the alternatives primarily due to its high construction cost. This option's CEI is approximately two times (1.9) the LRT Alternative's CEI and provides approximately 3,080 less hours of daily user benefits and 978,000 less hours of annual user benefits. If any of the alternatives

move forward into the next study phase, the factors contributing to the identification of the CEI, such as capital and operating costs and ridership, would be refined.

Provisional CEI Discussion

There were significant capped user benefits in all of the build alternatives as documented in *Appendix B: PEROW/WSAB Corridor AA Travel Demand Modeling Report.* This can be attributed to the TSM Alternative where the level and span of service provided by the identified projects does not correspond to the build options. In some part, this issue is related to Corridor characteristics that the study team and agencies struggled with in the Los Angeles County portion of the study area.

The proposed Orange County TSM projects provide a robust system of BRT lines on major streets already experiencing a high level of ridership, and peak period express freeway services providing connections to and from Long Beach and Los Angeles County. In Los Angeles County, it was difficult to identify potential bus service improvements. The area south from downtown Los Angeles to the City of South Gate (just north of the Metro Green Line) is densely developed and heavily served by current local and Metro Rapid bus operations. This portion of the Corridor was built in the 1920s and 1930s and has narrow streets with commercial buildings constructed to the edge of the sidewalk. Current bus operations are negatively impacted by the narrow street ROWs, peak period congestion in these heavily traveled corridors, and the high number of Metro and other service operators' buses operating through the area. Peak period bus speeds are between 10 to 14 mph even for the limited stop Metro Rapid service with signal priority improvements. In the future, the average bus speed will decline further with the projected population and employment growth, and related increase in daily travel. While there is an increasing demand for transit service, there is no physical room for additional bus service. Conversely, south of the Metro Green Line, while the rail line and commuter bus service to downtown Los Angeles are heavily used, transit demand is adequately served with 30 foot bus and city circulator services.

7.7 Land Use/Economic Plan Support

A majority of the Corridor cities encourage and support development of transit through policies in their respective general plans, specific plans, and designation of redevelopment areas and development of related plans. Common objectives include:

- Serve Corridor activity centers;
- Achieve a high quality of life through a balanced mix of attractive residential neighborhoods, high-quality public services and economically viable and attractive commercial areas;
- Preserve residential neighborhoods and commercial and industrial districts; and
- Provide an integrated transportation system for the safe and efficient movement of people and goods with a minimal disruption to the environment within and through the city.

Economic Development Effects

The proposed transit investment can provide opportunities for transit-oriented development (TOD), which can serve as catalysts for public and private economic revitalization. As demonstrated by other transit projects, such as those completed related to Metro projects, investments in transit station area development can provide economic benefits and enhanced quality of life to communities, while accommodating forecast population and employment growth and enhancing transit system ridership. Analysis shows that many of the alternatives have a high number of possible TOD opportunities. Additionally, the Corridor city and community plans discuss goals and objectives for developing strong and competitive commercial sectors. Plans identify that transit-oriented development could include a mixture of land uses, promote economic vitality, and serve the needs of the community through well-designed, safe, and accessible areas, while preserving historic and cultural character. A proposed station area land use and policy assessment was completed in order to identify current land uses, compatible transit development, economic development opportunities, and redevelopment potential. Table 7.14 presents an overview of transit supportive land use plans for each proposed station.

Table 7.14 – Summary of Transit Supportive Land Use Plans

City	Station Location	TOD Compatible	Specific Plans	Former Redevelopment Area
Los Angeles	Union Station	✓	✓	✓
	7th St./Alameda St.	✓	✓	✓
	Soto St./Olympic Blvd.	✓	✓	✓
Vernon	Leonis Blvd./District Blvd.	-	-	✓
	Vernon Ave.			
Huntington Park	Pacific Blvd.	✓	✓	✓
	Gage Ave.	✓	✓	✓
South Gate	Firestone Blvd.	✓	✓	✓
Downey	Gardendale St.	✓	✓	✓
	Metro Green Line Station	✓	✓	-
Paramount	Paramount Blvd./Rosecrans Ave.	✓	✓	✓
Bellflower	Bellflower Blvd.	✓	✓	✓
Cerritos	183rd St./Gridley Rd.	✓	✓	✓
Artesia	Pioneer Blvd.	✓	✓	✓
Cerritos	Bloomfield Ave.	✓	✓	✓
Cypress	Cypress College	✓	✓	✓

Table 7.14 – Summary of Transit Supportive Land Use Plans

City	Station Location	TOD Compatible	Specific Plans	Former Redevelopment Area
Anaheim	Knott Ave.	✓	-	✓
Stanton	Beach Blvd.	✓	✓	✓
Garden Grove	Magnolia St.	-	-	-
	Brookhurst St.	✓	✓	✓
	Euclid St.	✓	✓	✓
Santa Ana/Garden Grove	Harbor Blvd.	✓	✓	✓

7.8 Project Feasibility

The following provides a summary of the operational viability of each modal alternative:

- BRT Alternative – This service type is currently successfully operated by Metro and OCTA and could easily be implemented by either agency. The capacity of this alternative would not accommodate the future projected Corridor ridership.
- Street Car Alternative – This service is being studied by the cities of Santa Ana and Garden Grove for future implementation; no current Southern California operator has experience in providing Street Car service, though many U.S. cities do have extensive service experience. The typical Street Car vehicle is not currently approved to operate in California and a lighter LRT vehicle has been identified for future Orange County operations. All new facilities and staff to serve this option would be required.
- LRT Alternative – This service type is currently successfully operated by Metro and could easily be implemented.
- Low Speed Maglev Alternative – Low Speed Maglev service is currently operated only in Nagoya, Japan and there is no U.S. experience to draw upon at this time. The Low Speed Maglev would require a costly and lengthy approval process to obtain California and U.S. approval. All new facilities and staff to serve this option would be required.

The following provides a summary of the operational viability of each alignment alternative. All of the alternatives would face the significant challenge of securing the ability to utilize the San Pedro Subdivision to travel north from the PEROW/WSAB ROW.

- East Bank Alignment – For this alternative, there would be major coordination requirements that may preclude this alignment from moving forward, including crossing BNSF's very active intermodal facility (Hobart Yard), operating along the UP rail corridor that currently is operating at 85 to 90 percent capacity with a complex mix of freight and passenger traffic, including

multiple Metrolink and Amtrak lines and possibly CHST service in the future. It has the fewest maintenance yard options, but has the possibility of sharing a site with the Metro Gold Line.

- West Bank 1 Alignment – This alternative has a potential fatal flaw as the alignment is proposed to operate along the western edge of the Los Angeles River that is currently occupied by high tension electrical towers. Significant property acquisition would be required to accommodate any guideway structure in this area. As the alignment proceeds north, it would have to share the west bank ROW with Metrolink, Amtrak, and Metro Red Line operations, and possibly CHST service in the future. This option would have to utilize the constrained track system throat at Union Station.
- West Bank 2 Alignment – This alternative has significant challenges as it would have to cross the Redondo Junction which accommodates a high level of freight activity from the Alameda Corridor. Similar to the West Bank 1 alignment option, it would share the west bank ROW with Metrolink, Amtrak, and Metro Red Line operations, and possibly CHST service in the future. This option would have to utilize the constrained track system throat at Union Station.
- West Bank 3 Alignment – This alternative faces the challenges of coordinating with UP to use the tracks in the median of Randolph Street, and fitting through the streets of Vernon and Los Angeles as it travels north. It would transition to an underground configuration through much of downtown Los Angeles, but would transition to at-grade operations in Alameda Street in the Little Tokyo area in order to use the Metro Gold Line tracks into Union Station. It does avoid the constrained access into Union Station that the other two West Bank alternatives face.

7.9 Environmental and Community Impacts

At this preliminary level of analysis, with alignment engineering and station design information at a five percent level of completeness, there are minor differences in the level of environmental impacts between the Final Alternatives as summarized below in Table 7.15. While there does not appear to be any insurmountable environmental challenges, there are remaining areas of concern requiring further analysis during any subsequent Draft EIS/EIR effort.

Table 7.15 – Summary of Environmental Impacts

Alternative	Environmental and Community Impacts
No Build	The No Build Alternative is used for comparison purposes to assess the relative benefits and impacts of constructing a new transit project in the study area versus implementing only currently planned projects.
TSM Alternative	This alternative would: • Require minimal property acquisitions. • Have minimal impacts to visual and aesthetics. • Result in minimal impacts to noise and vibration.

Table 7.15 – Summary of Environmental Impacts

Alternative	Environmental and Community Impacts
TSM Alternative	• Impact air quality and climate change due to an increase in some mobile source emissions from an increase in the number of busses operating in the Corridor. • Have minimal impact on culturally sensitive resources or parkland and recreational facilities. • Have major traffic impacts due to the increase in the number of busses using the Corridor's freeway and arterial system. It may support land use plans.
BRT Alternatives	This alternative would: • Require minimal acquisition of property for dedicated bus lane space, other than what would be needed for maintenance facilities. • Have minor impacts to visual and aesthetics. • Have potentially minor impacts to noise and vibration from increased bus service. • Have major traffic impacts due to the increase in the number of buses using the Corridor's freeway and arterial system. • Potentially impact air quality and climate change due to the increase in bus emissions from a combustion of natural gas and other fuel. • Have minimal impacts to cultural or parklands resources. It may support land use plans.
Street Car Alternatives	This alternative would: • Support land use plans and provide economic development opportunities on a community-oriented rail system. • Require minor property acquisitions for rail ROW, specifically required for rail turning radius' and maintenance facilities. • Have minor noise and vibration impacts. • Lower travel speeds and more frequent stops could increase congestion and have other traffic impacts, primarily at intersections. • Have visual and aesthetic impacts, due to the overhead catenary system and other system aspects, when adjacent to residential or commercial land uses. • Have minor impacts on culturally sensitive resources or parkland and recreational facilities. • Not impact air quality because it is electrified and does not result in mobile source emissions.

Table 7.15 – Summary of Environmental Impacts

Alternative	Environmental and Community Impacts
LRT Alternatives	The alternative would: • Support land use plans and be a catalyst for public/private economic revitalization and station area development opportunities. • Require minor property acquisitions for rail ROW, specifically required for rail turning radius' and maintenance facilities. • Have minimal impact on culturally sensitive resources or parkland and recreational facilities. • Could have visual and aesthetic impacts, due to the overhead catenary system and other system aspects, when adjacent to residential or commercial land uses. • Have noise and vibration impacts, particularly adjacent to residential neighborhoods, or sensitive land uses such as schools and churches. • Not impact air quality impact air quality due to electrified operations and does not result in mobile source emissions. • Could have traffic impacts, particularly in at-grade sections and intersections.
Low Speed Maglev Alternatives	The alternative would: • Support land use plans and be a catalyst for public/private economic revitalization and station area development opportunities. • Require significant property acquisitions for system turning radius requirements, column structures, and a maintenance facility. • Have significant impacts to culturally significant resources, specifically older, established neighborhoods. • Have significant impacts to visual and aesthetic resources due to the scale of this entirely grade-separated alternative. The impacts would be significant adjacent to single family residential communities. Have visual impacts on parklands and recreational resources. • Could have minor noise and vibration impacts, particularly adjacent to residential neighborhoods and sensitive land uses. • Not impact air quality due to electrified operations and does not result in mobile source emissions. The low speed maglev technology proposed for the PEROW/WSAB Corridor project is a new technology and energy consumption information is not known. • Have some traffic impacts due to the structural column placement along the ROW to support the grade-separated system, particularly at intersections.

7.10 Comparative Summary

The resulting technical information, presented in Table 7.16, summarizes the technical information identified in the previous sections. In summary, while providing a new transportation improvement is important to the future mobility and vitality of the Corridor communities, adding any major transit system improvement into this densely built-out, urban corridor will also have significant benefits and impacts. An overview of how each modal alternative would serve the Corridor's needs and challenges, along with the identified impacts, challenges, and benefits follows.

All of the alternatives have the following benefits:

- Provide a new travel option and additional transportation system capacity to serve the Corridor's growing population and employment.
- Attract and serve a significant number of daily boardings and new transit riders.
- Better connect the Corridor, its cities, and its destinations and activity centers.
- Support city land use and economic development plans to varied degrees.
- Better serve the Corridor's low-income and transit-dependent households.

Conversely, all of the alternatives would have the following impacts and challenges to various degrees:

- Result in new environmental impacts, such as noise, vibration, visual, and privacy impacts.
- Result in traffic system impacts.
- Require acquisition.
- Require significant funding commitments to build and operate the future transit system.

Overview of Modal Alternatives

Implementation of the TSM Alternative would have the following key benefits:

- Increase Corridor transit ridership with forecasted 85,600 daily boardings and 35,800 new riders over the No Build Option.
- Increase the range of bus service types available; serve commuter travel patterns.
- Provide for implementation flexibility: improvements could be put into service over time by Metro, OCTA, and Long Beach Transit as resources become available; and supports local control as service can be reallocated to meet evolving transit needs.
- Have the lowest capital cost and the third lowest operating cost of the proposed alternatives.
- Have the lowest Cost-Effectiveness Index (CEI) of the alternatives – $8.15.

Implementation of the TSM Alternative would have the following key impacts and challenges:

- May only serve as an interim improvement as it may not offer sufficient system carrying capacity to address long-term travel demand; though it has the flexibility to possibly address.

- In public comments made throughout the study process, many participants were adverse to bus transit expressing that this option was a continuation of the current situation, and did not offer a new mode for the Corridor.
- Operate on same congested highway system as Corridor auto travel resulting in minimal, if any, improvement to travel speeds and travel times experienced by current bus riders.
- Result in air quality and climate change impacts due to increased bus activity contributing to local and regional congestion.
- While this option would better serve transit-dependent residents, it may not significantly contribute to attracting choice riders from their cars.
- Provide minimal service improvements to serving the Corridor's changing job patterns– connecting local residents to employment opportunities.
- Continue Los Angeles- and Orange County-centric services and does not address some of the identified transit service issues such as providing improved service coordination across county lines and between multiple service providers.

Implementation of the BRT alternatives would have the following key benefits:

- Increase Corridor transit ridership with forecasted 57,340 daily boardings and 18,200 new riders over the No Build Option for the Street-Running Alternative, and 67,210 boardings and 26,640 new riders for the HOV Lane-Running Alternative.
- Provide transit service serving local communities; the HOV Lane-Running Alternative would provide the better regional service of the two options.
- Increase the range of bus service types available; the HOV Lane-Running Alternative would serve commuter travel patterns.
- Increase transit service for low-income and transit-dependent households – the Street-Running Alternative would improve local service for transit-dependent communities.
- Have the second lowest capital and operating costs of the proposed alternatives.
- Have the second lowest Cost-Effectiveness Index (CEI) of the alternatives – $20.47 for the Street-Running Alternative and $16.60 for the HOV Lane-Running Option.

Implementation of the BRT alternatives would have the following key impacts and challenges:

- Even with attracting the lowest ridership and new riders among the alternatives, the projected ridership exceeds bus system capacity. While the proposed BRT service may be sufficient in early implementation stages, as the forecasted ridership reaches the 2035 demand levels, this alternative would be beyond carrying capacity provided by a BRT system, and riders would be better served by a guideway system alternative.
- A significant capital cost is required for PEROW/WSAB Area segment to build busway, stations, and signal coordination systems. If converted to a guideway system in future, this investment could not be reused and subregion would have to wait their turn in the funding cycle again.

- Operate on the same congested highway system as Corridor auto travel resulting in minimal improvement to travel speeds and travel times experienced by current bus riders; operating along congested highway system, it is subject to same accidents and travel delays as auto travel.
- Add buses to the Corridor's arterial and freeway system contributing to increased congestion levels.
- Result in air quality and climate change impacts due to increased bus activity contributing to local and regional congestion.
- Has a high operating and maintenance cost.
- In public comments made throughout the study process, many participants were adverse to bus transit expressing that this option was a continuation of the current situation, and did not offer a new mode for the Corridor.
- Many Corridor cities do not support this option; not seen as strongly supporting local land use and economic development plans.

Implementation of the Street Car Alternative would have the following key benefits:

- Increase Corridor transit ridership with forecasted 75,800 to 79,600 daily boardings and an average of 28,500 new riders over the No Build Option.
- Provide a new travel mode in Corridor.
- Support local land use and economic development plans.
- Provide air quality and local climate change benefits.

Implementation of the Street Car Alternative would have the following key impacts and challenges:

- Best serve local communities of the guideway alternatives; provide poor regional service.
- Provide minimal service improvement to serve changing job patterns – connecting local residents to regional jobs.
- In public comments made in the study process, many participants felt that this option did not provide the right fit for the Corridor. The slower travel speed and more frequent stops were seen as serving local travel needs, but not regional transportation needs.
- Vehicle type has several fatal flaws for this Corridor:
  1. Though analyzed in three-car trains to accommodate anticipated ridership demand, the selected vehicles cannot be coupled together and must be operated as single vehicles. This would not provide sufficient capacity to meet Corridor ridership demand, and would result in significant operational costs and traffic impacts due to need for more frequent trains.
  2. Cannot interline with Metro's urban rail system: selected vehicles are low floor vehicles and cannot be accommodated at Metro's platforms; Metro Design Criteria precludes use of low floor vehicles.
  3. Cannot share Metro rail facilities; could share future Santa Ana system facilities, though may overwhelm currently planned Street Car storage and maintenance yard facilities.

4. If another vehicle would be selected, it would be an LRT vehicle.
5. Would preclude the West Bank 3 alignment alternative: could not operate on Metro tracks from Little Tokyo into Union Station.
6. Street Car service and vehicles designed for short, local trips with fewer seats and more space provided for standing easy on-and-off, bicycles, and strollers. Longer Corridor trip riders would want seats. High level of standees may not meet Metro Transit Policy standards.
7. May not meet Federal Railroad Administration (FRA) requirements for operations in an active railroad ROW.

- New mode would require all new facilities and staff and operational learning curve;
- Require identification of system operator: Metro and OCTA would decline to operate a new mode; future Santa Ana system may be option.
- Have operating cost equal to or more than the LRT alternatives with no advantage over LRT service; more than Low Speed Maglev alternatives.
- Have the second highest CEI of the alternatives – $51.44 which does not currently meet the FTA threshold.

Implementation of the LRT Alternative would have the following key benefits:

- Provide the highest Corridor transit ridership among the proposed alternatives with a forecasted 87,200 daily boardings and an average of 32,300 new riders over the No Build Option.
- Offer highest travel speed and shortest travel time between Union Station and the SARTC.
- Provide local and regional service.
- Provide a new travel mode.
- Support for local land use and economic development plans demonstrated in region.
- Provide air quality and local climate change benefits.
- Provides service improvement to serve changing job patterns – connecting local residents to regional jobs – with direct service possible to Union Station and other Metro rail stations, providing the best regional system connectivity.
- New mode can share existing Metro rail transit facilities and staff; can interline with Metro system providing rider connectivity benefits.
- In public comments made in the study process, participants expressed the strongest support for the LRT Alternative. It was viewed as a familiar technology that has been proven successful locally, and that the Corridor's LRT system would be compatible with the Metro system.
- Could operate as fast as Low Speed Maglev Alternative if curve speeds were increased; would require revision to Metro Design Criteria.
- Provide highest cost-effectiveness among guideway alternatives: $48.23.

Implementation of the LRT Alternative would have the following impacts and challenges:

- Result in some significant environmental impacts requiring mitigation, primarily increases in noise, vibration, and traffic impacts
- Have the second highest capital and operating cost.

Implementation of the Low Speed Maglev Alternative would have the following key benefits:

- Provide high Corridor transit ridership with forecasted 72,300 to 76,000 daily boardings and an average of 27,900 new riders over the No Build Option.
- Offer the highest travel speed and shortest travel time from Union Station to the Harbor Boulevard Station.
- Have the lowest operating cost of the guideway alternatives.
- Provide local and regional service.
- Provide a new travel mode.
- Provide fast service improvement to serve changing job patterns – connecting local residents to regional jobs.
- Support local land use and economic development plans.
- Provide air quality and local climate change benefits.
- Have the lowest level of noise, vibration, and traffic impacts among the guideway alternatives.
- In public comments made in the study process, participants expressed the opinion that this modal option was a more cutting edge approach for the Corridor, and would provide quieter and cleaner service than the other alternatives.

Implementation of the Low Speed Maglev Alternative would have the following key impacts and challenges:

- Result in implementation concerns as only one system operating in world; the only existing system built as service for a world's fair and was not extended.
- Result in implementation costs and schedule constraints due to unproven technology in U.S. – would require lengthy and costly CPUC and FRA approval process, and FTA exemption for vehicles from Buy America requirement.
- Require the highest level of property acquisition to accommodate system turns.
- Result in significant environmental impacts in the following areas: privacy, visual and aesthetics, and cultural resources, as well as possible visual and noise impacts to parklands and sensitive land uses.
- In public comments made in the study process, participants expressed concerns that the technology is unproven in the U.S. and would be incompatible with existing systems.
- Private sector funding does not appear viable.
- New mode would require all new facilities and staff and operational learning curve;

- Require identification of a system operator.
- Have the highest capital cost among the alternatives due to the need for an entirely grade-separated system and unknown costs related to migrating the technology to Southern California.
- Has the highest CEI of the alternatives – $89.90.

7.11 Discussion/Comparison of Alignment Alternatives

The description of the build alternatives was divided into three alignment sections for analytical purposes and to reflect different coordination requirements and possible phasing decisions:

1. Northern Connection Area – consisted of the study area extending north from the PEROW/WSAB Corridor terminus in Paramount to downtown Los Angeles. Possible alignments to Union Station were explored along several active and inactive railroad ROWs, and four possible alignment options were identified and evaluated.
2. PEROW/WSAB Corridor ROW Area – included the PEROW/WSAB Corridor ROW now owned by Metro and OCTA, with only the reuse of the ROW considered in this area.
3. Southern Connection Area – consisted of the area extending from the southern PEROW/WSAB Corridor terminus at Raitt Street in Santa Ana east through the city's civic center and downtown to the SARTC; two alignment alternatives were identified and evaluated.

Overview of Northern Connection Area Alignment Options

There were two sets of options for the connection north from the PEROW/WSAB Corridor ROW to Union Station, either operating along the east or west bank of the Los Angeles:

- East Bank Alternative – This alignment alternative would operate north along the San Pedro Subdivision, cross a corner of the Hobart Intermodal Yard owned by Burlington Northern-Santa Fe (BNSF), to where the ROW intersects with the Union Pacific (UP)-owned ROW used for freight, Metrolink, and Amtrak operations. It would share the UP ROW for a short distance to where the ROW, now owned by Metro and operated by Metrolink, turns north to travel along the east bank of the Los Angeles River and then cross over the river into Union Station.
- West Bank Alternative – This alignment alternative would operate north along the San Pedro Subdivision to either operate along the west bank of the river to reach Union Station, or turn west to operate along a former railroad ROW and a Metro-owned ROW to reach Union Station. Three viable options were evaluated during the AA study:
  - West Bank 1 – This alternative would operate in its own ROW along the west bank of the Los Angeles River to just beyond the Redondo Junction where it would share the Metro-owned and Metrolink-operated ROW with Metrolink and Amtrak service, and possibly Metro Red Line operations.
  - West Bank 2 – This alternative would turn west to operate in the median of a infrequently used BNSF railroad ROW now owned by UP, through Huntington Park and then turn north to operate in the median of Pacific Boulevard, a former street car ROW until it intersects with the

Table 7.16 – Summary of Final Screening Results

Criteria	TSM	BRT		Street Car		LRT		Maglev	
		Street	HOV	East Bank	West Bank 3	East Bank	West Bank 3	East Bank	West Bank 3
Alignment Length (miles)	206	38.2	39.0	35.2	34.5	35.2	34.5	29.7	29.2
Number of Stations	Varies	27	22	23	24	22	23	17	18
End-to-End Run Time[1]	Varies	1:21:11	1:18:30	1:09:55	1:07:15	1:02:09	1:00:12	43:06[2]	43:00[2]
Average Speed (mph)	Varies	32.4	32.6	30.7	31.1	35.2	34.5	40.2	40.2
Daily Boardings	85,580	57,340	67,210	77,545	79,600	84,900	87,150	74,020	75,990
New Riders	35,820	18,120	26,640	28,900	28,950	32,730	32,780	28,430	28,430
Cost to Ride ($2011)	Varies[3]	$1.50	$2.45[4] $3.00[5]	$1.50	$1.50	$1.50	$1.50	$1.50 $8.75[6]	$1.50 $8.75[6]
Corridor Boardings	100,670	126,000	133,680	133,035	140,180	144,670	147,340	142,360	146,150
Cost to Build ($2010, millions)	$249	$1,075	$1,082	$2,575	$2,918	$2,969	$3,216	$6,6200	$7,476
Annual Operating Cost ($2011, millions)	$56.9	$41.6	$53.1	$217.9	$217.5	$216.0	$204.0	$152.3	$151.9
Cost-Effectiveness Index	$8.15	$20.47	$16.60		$51.44	$48.26	$48.23		$89.90
Environmental Impacts:									
Acquisition	Minor	0-10	0-15	15-20	15-20	15-20	15-20	50-70	50-70
Noise and Vibration	Minor	Minor	Minor	Medium	Medium	Major	Major	Minor	Minor
Visual and Privacy	Minor	Minor	Minor	Minor	Minor	Minor	Minor	Major	Major
AQ and Climate Change Benefits	Minor	Minor	Minor	Yes	Yes	Yes	Yes	Yes	Yes
Traffic Impacts	Major	Major	Major	Major	Major	Major	Major	Minor	Minor
Other Impacts	Minor	Minor	Minor	Minor	Minor	Minor	Minor	Major	Major
Transfers: Union Station	1	1	1	1	1	0	0	1	1
SARTC	1	1	1	1	1	1	1	2	2

Notes:
[1] Union Station – SARTC
[2] Union Station – Santa Ana Street Car harbor Boulevard Station.
[3] TSM Alternative includes local, limited stop, and Intercounty express service.
[4] Metro Silver Line fare.
[5] OCTA Intercounty Express Route fare.
[6] Private Operator fare.

Metro-owned Harbor Subdivision. It would follow the Harbor Subdivision ROW under the Redondo Junction and then operate north along the west bank similar to West Bank option 1.

- West Bank 3 – This alternative follows the same alignment as West Bank 2, but rather than turning to operate along the west bank of the river it continues north along the Harbor Subdivision and then along city streets and private property in a combination of aerial and underground configurations to daylight south of Metro Gold Line Eastside Tokyo Station where it utilizes the existing at-grade Metro Gold Line tracks to reach Union Station.

The following provides a summary of the viability of each alignment alternative:

- East Bank Alignment – This alternative, while typically the second most costly among the alignment alternatives, provides good travel speeds and run times. This alignment does not serve Huntington Park or downtown Los Angeles, but does serve an edge of Vernon and East Los Angeles. The guideway alternatives using this alignment typically have the second highest ridership and new riders, along with strong user benefits. The Low Speed Maglev East Bank Alternative had the highest user benefit per project boarding of all of the guideway alternatives.

  There would be major coordination requirements that may preclude this alignment from moving forward, including crossing BNSF's very active intermodal facility (Hobart Yard), operating along the UP rail corridor that currently is operating at 85 to 90 percent capacity with a complex mix of freight and passenger traffic – multiple Metrolink and Amtrak lines and possibly CAHSR service in the future. It has the fewest maintenance yard options, but has the strong possibility of sharing a future site with the Metro Gold Line.

- West Bank 1 Alignment – This alignment typically has the second lowest capital cost, it has the highest cost per mile among the guideway alternatives. It has the lowest travel speed and results in the lowest ridership and new riders. This alignment does not serve Huntington Park, downtown Los Angeles, but does serve an edge of Vernon.

  This alternative has a potential fatal flaw as the alignment is proposed to operate along the western edge of the Los Angeles River that is currently occupied by high tension electrical towers, and significant property acquisition would be required to accommodate any guideway structure. As the alignment proceeds north, it would have to share the west bank ROW with Metrolink, Amtrak, and Metro Red Line operations, and possibly CHST service in the future. This option would have to make a sharp curve, reducing travel speeds, to utilize the constrained track system throat at Union Station.

- West Bank 2 Alignment – While this alternative is typically the least costly alternative from a total cost and cost per mile, it does have the highest vehicle requirements and costs due to having the slowest operational speed and the resulting highest run times of all of the options.

Table 7.17 – Overview of Northern Connection Area Alignment Options

Option	Benefits	Challenges
East Bank 1	• Has second or third fastest end-to-end run times • Result in second highest ridership and new riders • May be able to share future Metro Gold Line maintenance yard	• Second highest capital cost • Does not serve Huntington Park or Downtown Los Angeles • Significant coordination requirements with multiple railroads, passenger service agencies, and possibly future CAHSR service
West Bank 1	• Second lowest total capital cost	• Second lowest travel times • Lowest ridership and new riders • Does not serve Huntington Park or Downtown Los Angeles • Potential fatal flaw along LA River due to ROW use by high tension electrical towers • Shares west bank ROW Metrolink, Amtrak, Metro Red Line operations, and possibly future CAHSR service • Operates through constrained track system throat into Union Station
West Bank 2	• Lowest total capital cost • Serves Huntington Park	• Slowest travel speed; highest run times • Highest vehicle needs and costs • Highest O&M cost • Third lowest ridership and new riders • Does not serve Downtown Los Angeles • Similar to West Bank 1: must share river bank ROW and enter through constrained Union Station throat
West Bank 3	• Fastest end-to-end travel time • Highest ridership and new riders • Lowest O&M cost • Serves Huntington Park and Downtown Los Angeles • Opportunity for LRT service to interline with Metro LRT system • Uses existing Gold Line tracks into Union Station	• Highest total capital cost (most stations and grade-separation) • Transitions from underground to at-grade operations in Alameda Street in Little Tokyo area

For the Low Speed Maglev Alternative, this alignment is the second most expensive from both a total cost and per mile perspective. A grade separation crossing of the Redondo Junction adds significantly to the cost of this alignment. This alignment does serve the hearts of Huntington Park and Vernon, but does not serve downtown Los Angeles.

This alternative has significant challenges as it would have to share the west bank ROW with Metrolink, Amtrak, and Metro Red Line operations, and possibly CHST service in the future. This option would have to make a sharp curve, reducing travel speeds, to utilize the constrained track system throat at Union Station.

- West Bank 3 Alignment – This alignment has the highest cost among all of the alternatives due to the highest percentage of grade-separation (Street Car and LRT) and the most stations, but it provides the fastest operational speeds and run times, and correspondingly, the highest ridership for all of the modal alternatives. This option serves the hearts of Huntington Park and Vernon, and the Central City East portion of downtown Los Angeles. It also provides the opportunity for the LRT alternatives to interline with the Metro rail system.

  This alternative faces the significant challenges of coordinating with UP to use the tracks in the median of Randolph Street, and fitting through the streets of Vernon and Los Angeles as it travels north. It would transition to an underground configuration through much of downtown Los Angeles, but would transition to at-grade operations in Alameda Street in the Little Tokyo area in order to use the Metro Gold Line tracks into Union Station. It does avoid the constrained access into Union Station that the other two West Bank alternatives face.

Overview of Southern Connection Area Alignment Options

At the southern end of the PEROW/WSAB Corridor ROW, all the alternatives, except the Low Speed Maglev Alternative, would leave the ROW to operate at-grade on Santa Ana city streets along one of two alternative routes which would have following benefits and challenges. The Low Speed Maglev Alternative would end at Harbor Boulevard with passengers transferring to the Santa Ana-Garden Grove Fixed Guideway Project to complete their trip. The BRT, Street Car, and LRT alternatives would leave the former PE ROW to operate on one of two alternative routes:

- Harbor Boulevard/1st Street/SARTC Alternative would leave the Corridor ROW after a future Harbor Boulevard Station to travel south on Harbor Boulevard, east on 1st Street, and then north on a realigned Santiago Street to the SARTC.
- Westminster Boulevard/17th Street/Main Street Alternative would serve the future Harbor Boulevard Station and then travel east on Westminster Boulevard/17th Street, and south on Main Street where riders would transfer to future Santa Ana-Garden Grove Street Car system to travel to the SARTC.

The benefits and challenges of the two alignment alternatives are presented below in Table 7.18.

Table 7.18 – Overview of Southern Connection Area Alignment Options

Option	Benefits	Challenges
Westminster/ 17th/Main	• Lower total capital cost (3.7 miles) shorter alignment length	• Has fewer stations • No direct connection to the SARTC • Lower ridership and new riders • Sensitive land uses on Westminster Boulevard/17th Street • Constrained ROW width on Main Street; lined with historic buildings • No possible maintenance facility location in Santa Ana
Harbor/1st/ SARTC	• Higher ridership and new riders • Direct connection to the SARTC • Possible maintenance facility in the SARTC area	• Higher capital cost due to longer alignment • Higher number of impacted Intersections

7.12 Recommended Alternatives

To be added upon completion of outreach efforts.